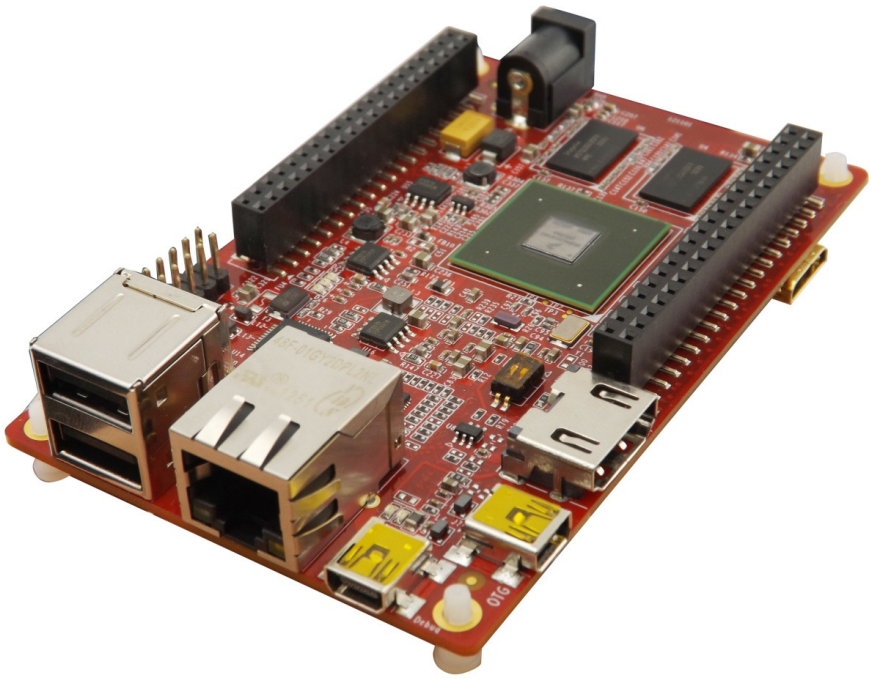
MarS Board

Freescale i.MX6Dual Core ARM Evaluation Platform

By

Embest
A Premier Farnell Company



User Manual

Version 1.0

Dated: 5th Dec 2013

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Revision History:

Version	Date	Description
1.0	05/12/2013	Original Version

Table of Contents

1 Product Overview 1

1.1 Introduction 1

1.2 Kit Contents 1

1.3 Board Interfaces 2

1.4 System Block Diagram 3

1.5 Physical Dimensions (mm) 4

2 Hardware Features 5

2.1 Processor 5

2.2 On-Board Memory 5

2.3 On-Board Interfaces 5

2.4 On-Board Interface Signals 6

2.5 Operational Parameters 6

3 Hardware Details 7

3.1 CPU Introduction 7

3.2 Clock Signals 7

3.3 Reset Signal 7

3.4 General Interfaces 8

3.5 Display Interface 8

3.6 3D Graphics Acceleration System 8

3.7 Peripheral ICs 8

3.7.1 eMMC Flash NCEMBM11-04G 8

3.7.2 DDR H5TQ2G63DFR-H9C 9

3.7.3 AR8035 Ethernet PHY 9

3.7.4 FE1.1 USB Hub 9

3.7.5 FT232RQ USB to UART Chip 10

3.8 Hardware Interfaces on Mars Board 10

3.8.1 Power Jack (J8) 10

3.8.2 HDMI Interface (J1) 11

3.8.3 LVDS Interface (J3) 11

3.8.4 USB OTG Interface (J7) 12
3.8.5 USB Debug Interface (J9) 12
3.8.6 Ethernet Interface (J2) 13
3.8.7 USB Hub Interface (Hub1) 13
3.8.8 USB Hub Extension Interface (J21) 14
3.8.9 TF Card Interface (J13)..... 14
3.8.10 LCD Interface (J12) 14
3.8.11 AUDMUX Interface (J11) 16
3.8.12 CAN1 Interface (J11) 16
3.8.13 CAN2 Interface (J11) 16
3.8.14 ECSPI2 Interface (J10) 16
3.8.15 I2C1 Interface (J11) 17
3.8.16 I2C3 Interface (J11) 17
3.8.17 IPU1 (Image Processing Unit 1) Interface (J11) ... 17
3.8.18 KPP Keyboard Interface (J11) 17
3.8.19 PWM Interface (J10 & J11) 18
3.8.20 GPMI (General Purpose Memory Interface) (J10).. 18
3.8.21 SPDIF (Sony/Philips Digital Interface) (J10)..... 18
3.8.22 UART1 Interface (J11) 19
3.8.23 UART3 Interface (J10) 19
3.8.24 UART4 Interface (J11) 19
3.8.25 UART5 Interface (J11) 19
3.8.26 USDHC1 Interface (J10)..... 20
3.8.27 ESAI (J10 & J11)..... 20
4 Software Features 21
4.1 Software Introduction 21
4.2 Linux Components 21
4.3 Android Components..... 22
4.4 Setting up HyperTerminal 23
4.5 Downloading and Running an Operating System 24
4.6 Micrium uC/OS System Demonstration 28
4.7 Display Mode Configurations of Linux & Android Systems 28
4.7.1 Display with 4.3” LCD 30

4.7.2 Display with 7” LCD 30
4.7.3 Display with 9.7” LVDS 30
4.7.4 Display with VGA8000 30
4.7.5 Display with HDMI 31
4.7.6 Dual Display with LCD & HDMI 31
4.7.7 Dual Display with LVDS & HDMI 32
5 Making Images 33
5.1 Making Images for Linux 33
5.1.1 Getting Tools and Source Code 33
5.1.2 Compiling System Images 34
5.2 Making Images for Android 35
5.2.1 Getting Repo Source Code 35
5.2.2 Compiling System Images 36
6 Appendix 1 – Installing Ubuntu Linux System 38
6.1 Installing VirtualBox 38
6.2 Installing Ubuntu Linux System 43

1 Product Overview

1.1 Introduction

MarS Board is a low cost, highly integrated evaluation board designed by Embest Technology and based on Freescale's i.MX 6Dual ARM Cortex-A9 processor. The i.MX 6Dual integrates an ARM Cortex-A9 core of up to 1GHz, 2D and 3D graphics processors and 3D 1080p video processor. MarS Board is featured with abundant interfaces such as HDMI, LVDS, mini USB OTG, mini USB debug, RJ45, USB host, TF card and LCD display to help developers from different fields including netbooks, all-in-one PCs, high-end mobile Internet devices, handhold computers, portable media players, game consoles and portable navigation devices.

1.2 Kit Contents

- ✓ MarS Board
- ✓ **Optional** accessories package including:
  - ✓ HDMI Cable
  - ✓ Mini USB Cable
  - ✓ 5V@4A power adapter
  - ✓ 4GB TF Card
  - ✓ Gigabit Ethernet line
- ✓ **Optional** 4.3" or 7" touchscreen LCD
- ✓ **Optional** 9.7" touchscreen TFT (LVDS)

1.3 Board Interfaces

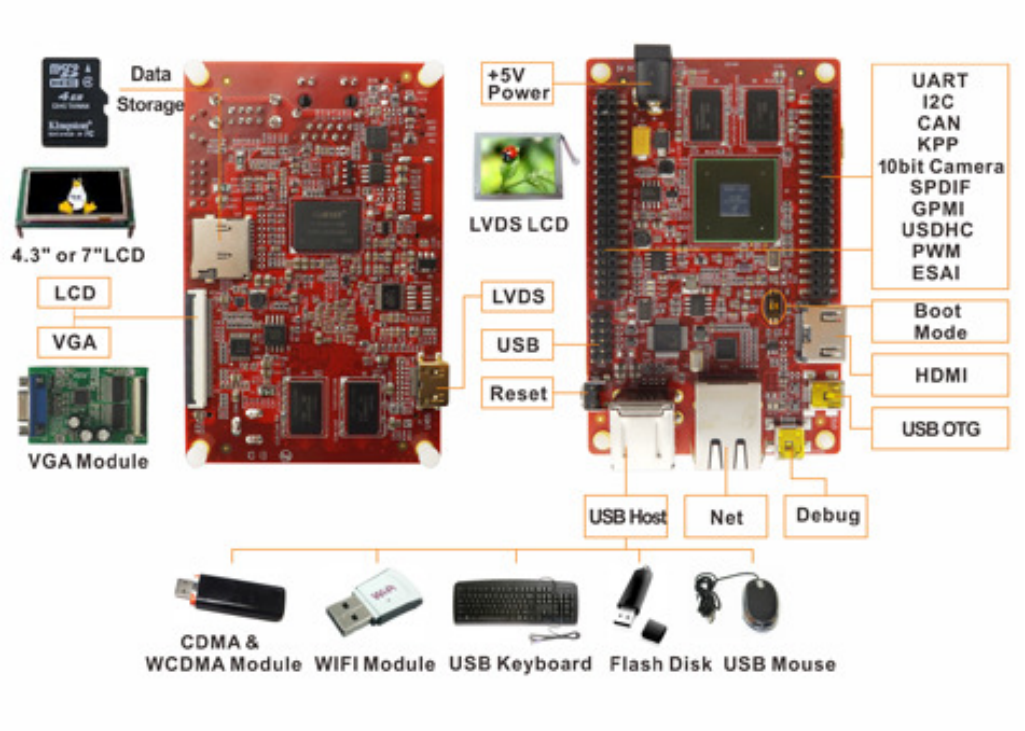


Figure 1: **MarS Board Interfaces**

1.4 System Block Diagram

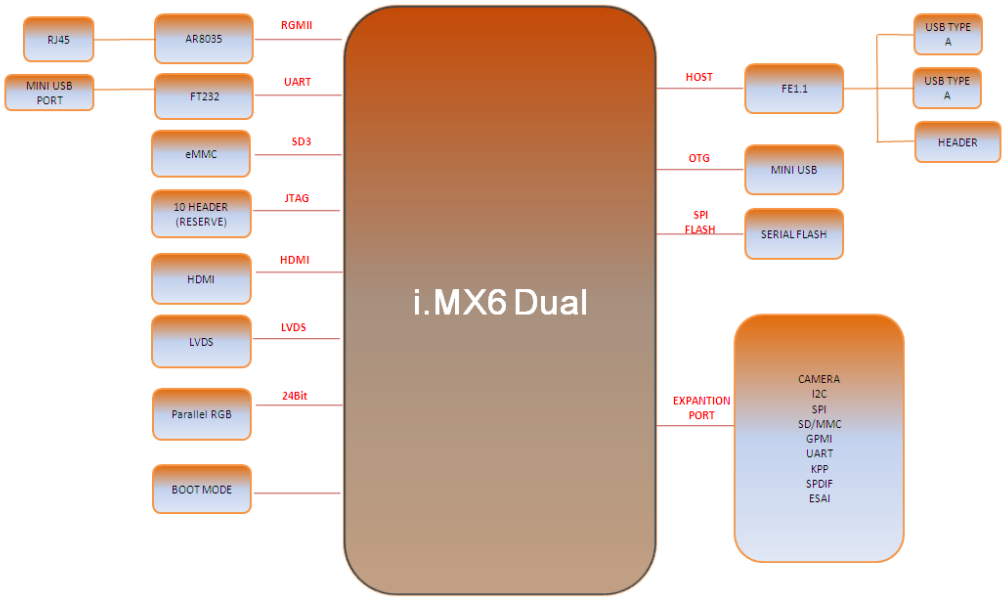


Figure 2: *MarS Board System Block Diagram*

1.5 Physical Dimensions (mm)

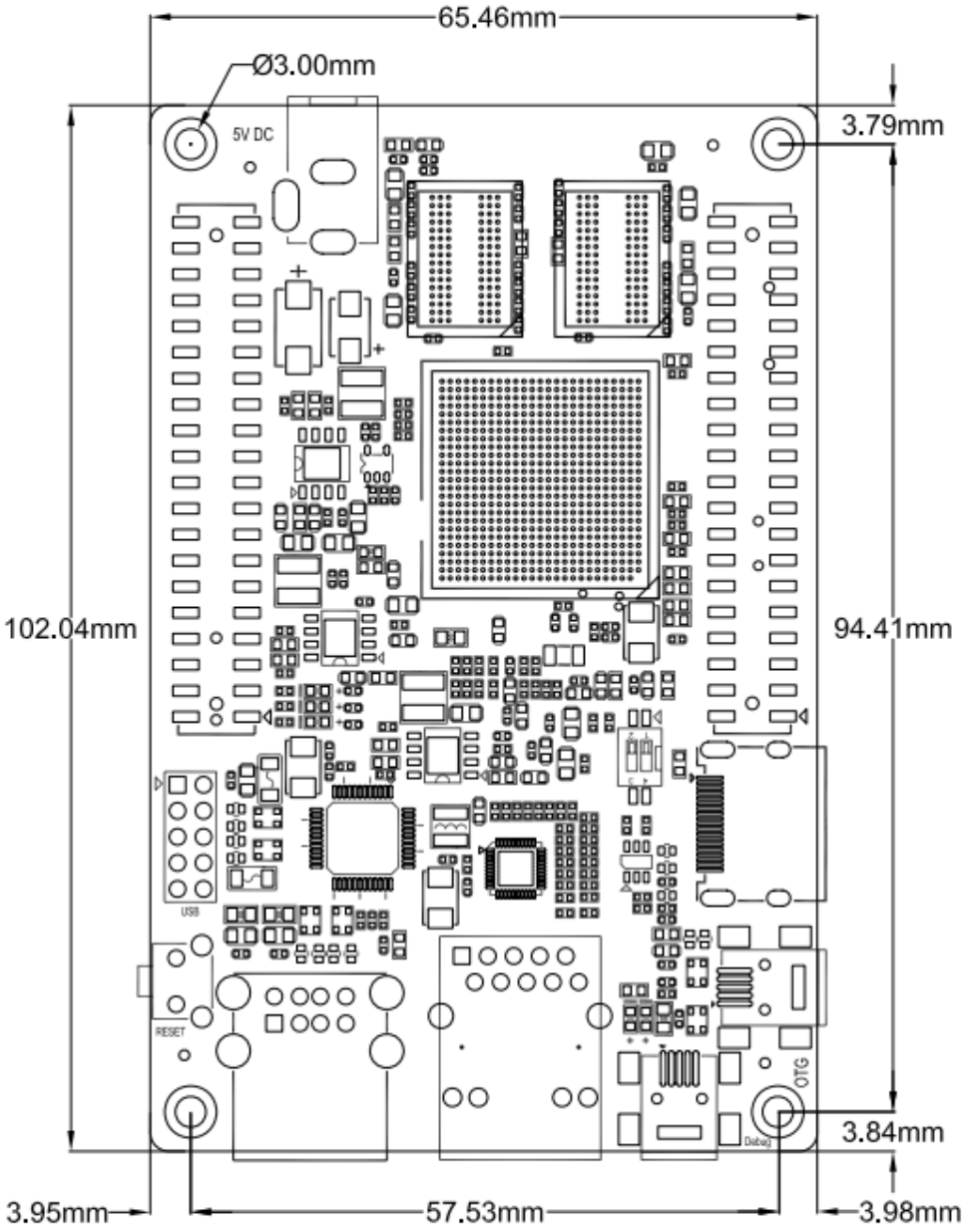


Figure 3: *MarS Board Hardware Dimensions*

2 Hardware Features

2.1 Processor

- i.MX 6Dual integrated ARM Cortex™-A9 core
- 32 KB L1 Instruction Cache
- 32 KB L1 Data Cache
- Private Timer and Watchdog
- Cortex-A9 NEON MPE (Media Processing Engine) Coprocessor
- 2D/3D Graphics Processors

2.2 On-Board Memory

- 4GByte eMMC
- Four sets of 256MB DDR3 SDRAM (1GB in total)

2.3 On-Board Interfaces

- HDMI Interface
- LVDS Interface
- LCD Interface
- Two 480Mbps High-Speed USB2.0 Hub Interfaces
- Two 480Mbps High-Speed USB2.0 Header Interfaces
- 480Mbps High-Speed USB2.0 OTG Interface
- COM-USB Debug (com2) Interface
- TF Card Interface
- 10/100M/1Gbps RJ45 Network Interface
- Boot Mode Interface
- Reset Button

2.4 On-Board Interface Signals

- AUDMUX (Digital Audio Multiplexer) Signal
- Two CAN Signals
- ECSPI2 (Enhanced Configurable SPI) Signal
- Two I2C Signals
- Camera/ Parallel signal, up to 16 bit
- KPP (Keypad Port) Signal
- PWM (Pulse Width Modulation) Signal
- GPMI (General Purpose Memory Interface) Signal
- SPDIF (Sony/Philips Digital Interface) Signal
- Four UART Signals
- USDHC1 (Ultra Secured Digital Host Controller) Signal
- ESAI (Enhanced Serial Audio Interface) Signal

Note:

📖 The pins of some of the interfaces listed above are multiplexed. Please refer to relevant data sheets for the processor and product schematics.

2.5 Operational Parameters

- Dimensions: 65mm x 102mm
- Operation Temperature: 0°C ~ 70°C
- Operating Humidity: 20% ~ 90% (Non-condensing)
- Power Supply: 5V

3 Hardware Details

This chapter will describe the hardware composition of MarS Board by briefly introducing the CPU, peripheral ICs and the pinouts of the many interfaces on the product.

3.1 CPU Introduction

i.MX 6Dual is an ARM Cortex-A9-based dual-core processor from Freescale. It runs at up to 1GHz, integrates 2D/3D graphics, a 3D 1080p video processor and power management. The i.MX 6Dual also provides 64-bit DDR3/LVDDR3/LVDDR2-1066 interfaces as well as many other interfaces for devices such as such as HD displays and cameras.

3.2 Clock Signals

The clock signals of the i.MX 6Dual include a 32.768 KHz RTC clock and a 24 MHz external clock;

- **RTC Clock:** generated by an external crystal for low-frequency calculation;
- **External Clock:** used to generate main clock signal for PLL, CMM and other modules;

3.3 Reset Signal

The reset signal is determined by POR_B of CPU; a low level signal trigger resetting.

3.4 General Interfaces

General interfaces include 7 sets of GPIOs, each providing 32 dedicated GPIO pins (with the exception of GPIO7 which has 14 pins), and therefore the total pin number of GPIOs can be up to 206.

3.5 Display Interface

- Parallel 24-bit RGB interface supporting 60Hz WUXGA output
- Two LVDS interfaces supporting up to 165 MP/s output
- HDMI 1.4 interface
- MIPI/DSI interface with 1Gbps output rate

3.6 3D Graphics Acceleration System

The i.MX 6Dual integrates a GPU3Dv4 3D GPU (graphics processing unit) which provides hardware acceleration for 3D graphics algorithms and allows desktop quality interactive graphics applications to reach resolutions of up to 1080p. The GPU3D supports OpenGL ES 2.0, including extensions; OpenGL ES 1.1, and OpenVG 1.1.

Additionally, the i.MX 6Dual also has a GPUVGv2 vector GPU which provides hardware acceleration for 2D graphics algorithms.

3.7 Peripheral ICs

3.7.1 eMMC Flash NCEMBM11-04G

The NCEMBM11-04G is an eMMC flash memory IC included on the MarS Board with 4GB memory space. The IC supports high-speed DDR data transfer at a clock frequency of up to 52MHz, as well as three widths of data line: 1-bit (default), 4-bit and 8-bit. The synchronous power management

allows the IC to feature fast boot, automatic termination and sleep modes. The NCEMBM11-04G also supports high-speed, dual-data-transfer boot mode.

3.7.2 DDR H5TQ2G63DFR-H9C

The H5TQ2G63DFR-H9C is a DDR3 SDRAM IC included on the MarS Board; with 256MB memory space it is suited for high-capacity and high-bandwidth applications. It supports differential clock input, differential data strobe, automatic refresh and asynchronous pin reset. The MarS Board contains four H5TQ2G63DFR-H9C ICs adding up to 1GB of available memory.

3.7.3 AR8035 Ethernet PHY

The AR8035 is a single port 10/100/1000 Mbps tri-speed Ethernet PHY featuring low power consumption and low cost. AR8035 supports the MAC.TM RGMII interface and the IEEE 802.3az-2010, Energy Efficient Ethernet (EEE) standard through proprietary SmartEEE technology; improving energy efficiency in systems using legacy MAC devices without 802.3az support. Using the AR8035 the MarS Board can be either connected to a hub via a straight-through network cable, or to a PC via a cross-over network cable.

3.7.4 FE1.1 USB Hub

The FE1.1 is a USB 2.0 high-speed 4-port hub solution. It uses USB3320 to provide 4 extended USB interfaces with support for high-speed (480MHz), full-speed (2MHz) and low-speed (1.5MHz) modes.

3.7.5 FT232RQ USB to UART Chip

The FT232RQ is a USB-to-UART chip which powers the mini USB debug interface on the MarS Board. It integrates a 1024-bit internal EEPROM and CBUS I/O configuration; and supports data transfer rates from 300 baud to 3 Mbaud at TLL levels.

3.8 Hardware Interfaces on Mars Board

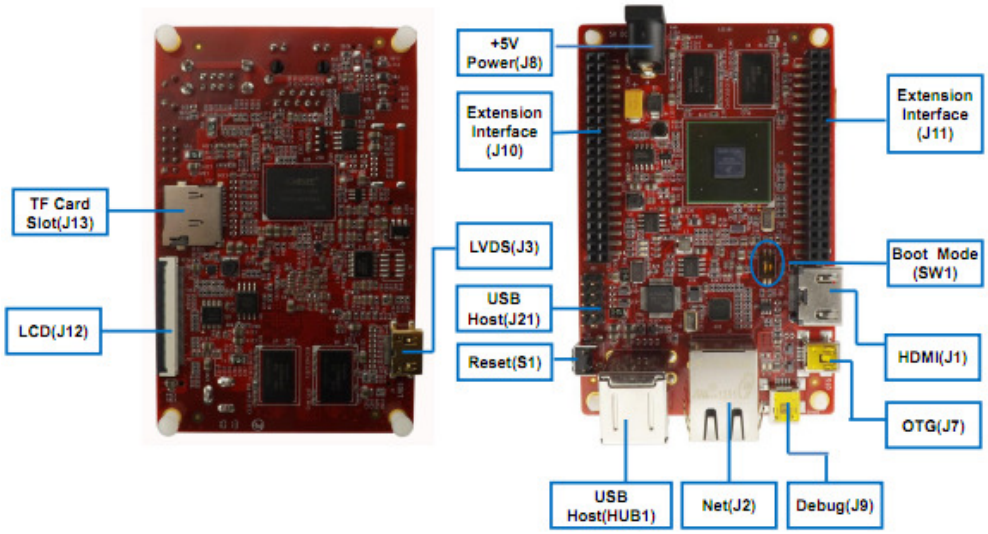


Figure 4: *Hardware Interfaces on the MarS Board*

3.8.1 Power Jack (J8)

Pins	Definitions	Descriptions
1	GND	GND
2	+5V	Power supply (+5V) 4A (Type)
3	+5V	Power supply (+5V) 4A (Type)

3.8.2 HDMI Interface (J1)

Pins	Definitions	Descriptions
1	DAT2+	TMDS data 2+
2	DAT2_S	TMDS data 2 shield
3	DAT2-	TMDS data 2-
4	DAT1+	TMDS data 1+
5	DAT1_S	TMDS data 1 shield
6	DAT1-	TMDS data 1-
7	DAT0+	TMDS data 0+
8	DAT0_S	TMDS data 0 shield
9	DAT0-	TMDS data 0-
10	CLK+	TMDS data clock+
11	CLK_S	TMDS data clock shield
12	CLK-	TMDS data clock-
13	NC	NC
14	NC	NC
15	SCL	IIC master serial clock
16	SDA	IIC serial bidirectional data
17	GND	GND
18	5V	5V
19	HPLG	Hot plug and play detect

3.8.3 LVDS Interface (J3)

Pins	Definitions	Descriptions
1	3V3	+3.3V
2	LVDS_TX2_P	LVDS Data2+
3	LVDS_TX2_N	LVDS Data2-
4	GND	GND
5	LVDS_TX1_P	LVDS Data1+
6	LVDS_TX1_N	LVDS Data1-
7	GND	GND
8	LVDS_TX0_P	LVDS Data0+
9	LVDS_TX0_N	LVDS Data-
10	GND	GND
11	LVDS_CLK_P	LVDS_CLK+
12	LVDS_CLK_N	LVDS_CLK-
13	LCD_PWR_EN	Touch Reset Signal
14	Touch_Int	Touch Interrupt Signal
15	I2C_SCL	IIC Master Serial Clock

Pins	Definitions	Descriptions
16	I2C_SDA	IIC Master Serial Data
17	LED_PWR_EN	Backlight Enable
18	5V	+5V
19	PWM	Pulse Width Modulation

3.8.4 USB OTG Interface (J7)

Pins	Definitions	Descriptions
1	VBUS	+5V
2	DN	USB Data-
3	DP	USB Data+
4	ID	USB ID
5	GND	GND

3.8.5 USB Debug Interface (J9)

Pins	Definitions	Descriptions
1	VBUS	+5V
2	DN	USB Debug Data-
3	DP	USB Debug Data+
4	NC	NC
5	GND	GND

3.8.6 Ethernet Interface (J2)

Pins	Definitions	Descriptions
1	TD1+	TD1+ output
2	TD1-	TD1- output
3	TD2+	TD2+ output
4	TD2-	TD2- output
5	TCT	2.5V Power for TD
6	RCT	2.5V Power for RD
7	RD1+	RD1+ input
8	RD1-	RD1- input
9	RD2+	RD2+ input
10	RD2-	RD2- input
11	GRLA	Green LED link signal
12	GRLC	Power supply for Green LED
13	YELC	Yellow LED action signal
14	YELA	Power supply for Yellow LED

3.8.7 USB Hub Interface (Hub1)

Pins	Definitions	Descriptions
1	APV	5V power for HUB A
2	AD-	USB HUB A Data-
3	AD+	USB Debug Data+
4	GNDA	USB HUB A GND
5	BPV	5V power for HUB B
6	BD-	USB HUB B Data-
7	BD+	USB HUB B Data+
8	GNDB	USB HUB B GND

3.8.8 USB Hub Extension Interface (J21)

Pins	Definitions	Descriptions
1	PWR2	5V power for HUB 2
2	PWR1	5V power for HUB 1
3	DM2	USB HUB 2 Data-
4	DM1	USB HUB 1 Data-
5	DP2	USB HUB 2 Data+
6	DP1	USB HUB 1 Data+
7	GND	GND
8	GND	GND
9	GND	GND
10	GND	GND

3.8.9 TF Card Interface (J13)

Pins	Definitions	Descriptions
1	DAT2	Card data 2
2	DAT3	Card data 3
3	CMD	Command Signal
4	VDD	VDD
5	CLK	Clock
6	VSS	VSS
7	DAT0	Card data 0
8	DAT1	Card data 1
9	CD	Card detect

3.8.10 LCD Interface (J12)

Pins	Definitions	Descriptions
1	B0	GND
2	B1	GND
3	B2	GND
4	B3	LCD Pixel data bit 0
5	B4	LCD Pixel data bit 1
6	B5	LCD Pixel data bit 2
7	B6	LCD Pixel data bit 3
8	B7	LCD Pixel data bit 4
9	GND1	GND

Pins	Definitions	Descriptions
10	G0	GND
11	G1	GND
12	G2	LCD Pixel data bit 5
13	G3	LCD Pixel data bit 6
14	G4	LCD Pixel data bit 7
15	G5	LCD Pixel data bit 8
16	G6	LCD Pixel data bit 9
17	G7	LCD Pixel data bit 10
18	GND2	GND
19	R0	GND
20	R1	GND
21	R2	GND
22	R3	LCD Pixel data bit 11
23	R4	LCD Pixel data bit 12
24	R5	LCD Pixel data bit 13
25	R6	LCD Pixel data bit 14
26	R7	LCD Pixel data bit 15
27	GND3	GND
28	DEN	AC bias control (STN) or pixel data enable (TFT)
29	HSYNC	LCD Horizontal Synchronization
30	VSYNC	LCD Vertical Synchronization
31	GND	GND
32	CLK	LCD Pixel Clock
33	GND4	GND
34	X+	X+ Position Input
35	X-	X- Position Input
36	Y+	Y+ Position Input
37	Y-	Y- Position Input
38	SPI_CLK	SPI serial clock
39	SPI_MOSI	SPI Master Output, Slave Input
40	SPI_MISO	SPI Master Input, Slave Output
41	SPI_CS	SPI Chip Select
42	IIC_CLK	IIC master serial clock
43	IIC_DAT	IIC serial bidirectional data
44	GND5	GND
45	VDD1	3.3V
46	VDD2	3.3V
47	VDD3	5V
48	VDD4	5V
49	RESET	Reset
50	PWREN	Backlight enable

Note:

🕮 To avoid causing damage, **Do Not** hot-plug the LCD flat cable.

3.8.11 AUDMUX (Digital Audio Multiplexer) Interface (J11)

Pins	Definitions	Descriptions
31	AUD3_RXD	Receive audio data
25	AUD3_TXC	Audio transmission clock
27	AUD3_TXD	Transmit audio data
29	AUD3_TXFS	Transmit audio frame signal

3.8.12 CAN1 Interface (J11)

Pins	Definitions	Descriptions
33	RXCAN	Receive data
35	TXCAN	Transmit data

3.8.13 CAN2 Interface (J11)

Pins	Definitions	Descriptions
37	RXCAN	Receive data
39	TXCAN	Transmit data

3.8.14 ECSPI2 (Enhanced Configurable SPI) Interface (J10)

Pins	Definitions	Descriptions
21	MISO	Master Input Salve Output
19	MOSI	Master Output Salve Input
17	SCLK	Clock
15	SS0	Chip select

3.8.15 I2C1 Interface (J11)

Pins	Definitions	Descriptions
38	SCL	Master serial clock
40	SDA	Master serial data

3.8.16 I2C3 Interface (J11)

Pins	Definitions	Descriptions
3	SCL	Master serial clock
5	SDA	Master serial data

3.8.17 IPU1 (Image Processing Unit 1) Interface (J11)

Pins	Definitions	Descriptions
4	CSI0_DAT12	Digital image data bit 12
6	CSI0_DAT13	Digital image data bit 13
8	CSI0_DAT14	Digital image data bit 14
10	CSI0_DAT15	Digital image data bit 15
12	CSI0_DAT16	Digital image data bit 16
14	CSI0_DAT17	Digital image data bit 17
16	CSI0_DAT18	Digital image data bit 18
18	CSI0_DAT19	Digital image data bit 19
21	CSI0_DATA_EN	Digital image data write enable
17	CSI0_HSYNC	Horizontal synchronization
19	CSI0_PIXCLK	Pixel clock
23	CSI0_VSYNC	Vertical synchronization

3.8.18 KPP Keyboard Interface (J11)

Pins	Definitions	Descriptions
30	COL[0]	Keypad matrix column 0 output
34	COL[1]	Keypad matrix column 1 output
35	COL[2]	Keypad matrix column 2 output
28	ROW[0]	Keypad matrix row 0 input
32	ROW[1]	Keypad matrix row 1 input
37	ROW[2]	Keypad matrix row 1 input

3.8.19 PWM (Pulse Width Modulation) Interface (J10 & J11)

Pins	Definitions	Descriptions
26(J11)	PWM1	Pulse Width Modulation
13(J10)	PWM4	Pulse Width Modulation

3.8.20 GPMI (General Purpose Memory Interface) (J10)

Pins	Definitions	Descriptions
6	ALE	Address Latch Enable
4	CE0N	CHIP ENABLE
3	CLE	Command Latch Enable
14	D0	Data 0
16	D1	Data 1
18	D2	Data 2
20	D3	Data 3
22	D4	Data 4
24	D5	Data 5
26	D6	Data 6
28	D7	Data 7
34	DQS	Data Strobe Control
32	RDN	Read Enable
12	READY0	Ready Busy
10	WP	Write Protect
30	WRN	Write Enable

3.8.21 SPDIF (Sony/Philips Digital Interface) (J10)

Pins	Definitions	Descriptions
25	IN1	I2S data Input
23	OUT1	I2S data output
29	PLOCK	System master clock
27	SPDIF_EXTCLK	I2S frame clock
31	SRCLK	I2S bit clock

3.8.22 UART1 Interface (J11)

Pins	Definitions	Descriptions
7	CTS	Clear To Send
9	RTS	Request To Send
13	RXD_MUX	Receive data
11	TXD_MUX	Transmit data

3.8.23 UART3 Interface (J10)

Pins	Definitions	Descriptions
33	CTS	Clear To Send
35	RTS	Request To Send
36	RXD_MUX	Receive data
38	TXD_MUX	Transmit data

3.8.24 UART4 Interface (J11)

Pins	Definitions	Descriptions
28	RXD_MUX	Receive data
30	TXD_MUX	Transmit data

3.8.25 UART5 Interface (J11)

Pins	Definitions	Descriptions
32	RXD_MUX	Receive data
34	TXD_MUX	Transmit data

3.8.26 USDHC1 Interface (J10)

Pins	Definitions	Descriptions
39	CD	Card detect
3	CLK	Card clock
1	CMD	Command Signal
5	DAT0	Card data 0
7	DAT1	Card data 1
9	DAT2	Card data 2
11	DAT3	Card data 3

3.8.27 ESAI (Enhanced Serial Audio Interface) (J10 & J11)

Pins	Definitions	Descriptions
26(J11)	FSR	Frame Sync for Receiver
15(J11)	FST	Frame Sync for Transmitter
22(J11)	HCKR	High Frequency Clock for Receiver
23(J10)	HCKT	High Frequency Clock for Transmitter
39(J10)	SCKR	Receiver Serial Clock
27(J10)	SCKT	Transmitter Serial Clock
24(J11)	TX0	Serial output 0
20(J11)	TX1	Serial output 1
3(J11)	TX2_RX3	Serial output 2_Serial Input 3
25(J10)	TX3_RX2	Serial output 3_Serial Input 2
29(J10)	TX4_RX1	Serial output 4_Serial Input 1
31(J10)	TX5_RX0	Serial output 5_Serial Input 0

4 Software Features

Prior to commencing use of the MarS Board, please read the following sections to familiarise yourself with the system images, driver code and tools which may be involved during the development process.

4.1 Software Introduction

The table shown below lists the versions of Linux and Android systems that will be used later, as well as the device drivers.

Types		Notes
OS	Linux	Version 3.0.15
	Android	Version 4.0.4
Device Drivers	Serial	Series driver
	RTC	Hardware clock driver
	Net	10/100/Gb IEEE1588 Ethernet
	Flash	SPI flash driver
	Display	Three display ports (RGB, LVDS, and HDMI 1.4a)
	mmc/sd	One SD 3.0/SDXC card slot & eMMC
	USB	3 High speed USB ports (2xHost, 1xOTG)
	Audio	Digital (HDMI) audio
	LED	User LED driver

4.2 Linux Components

The following tables list the specific images and eMMC storage partitions required to build a Linux system, (X is the root of the CD). All the files can be downloaded from www.element14.com/iMX6

Images	Paths
u-boot image	X:/linux/image/u-boot.bin
kernel image	X:/linux/image/uImage
Ubuntu system image	X:/linux/image/oneiric.tgz

Partition type/index	Name	Start Offset	Size	File System	Content
N/A	BOOT Loader	0	1MB	N/A	bootloader
N/A	Kernel	1M	9MB	N/A	uImage
Primary 1	Rootfs	10M	Total - Other	EXT3	oneiric.tgz

Note:

- **Partition type/index:** defined in MBR.
- **Name:** only applies to the Android OS. You can ignore it when creating these partitions.
- **Start Offset:** shows where partition starts with unit in MB.

4.3 Android Components

The following tables list the specific images and eMMC storage partitions required to build an Android system, (X is the root of the CD). All the files can be downloaded from www.element14.com/iMX6

Images	Paths
u-boot image	X:/android/image/u-boot.bin
boot image	X:/android/image/boot.img
Android system root image	X:/android/image/system.img
Recovery root image	X:/android/image/recovery.img

Partition type/index	Name	Start Offset	Size	File System	Content
N/A	BOOT Loader	0	1MB	N/A	bootloader
Primary 1	Boot	8M	8MB	boot.img format, a kernel + ramdisk	boot.img
Primary 2	Recovery	Follow Boot	8MB	boot.img format, a kernel + ramdisk	recovery.img
Logic 5 (Extended 3)	SYSTEM	Follow Recovery	512MB	EXT4. Mount as /system	Android system files under /system/ dir
Logic 6 (Extended 3)	CACHE	follow SYSTEM	256MB	EXT4. Mount as /cache	Android cache, for image store for OTA
Logic 7 (Extended 3)	DATA	follow CACHE	> 1024MB	EXT4 Mount at /data	Application data storage for system

Partition type/index	Name	Start Offset	Size	File System	Content
					applications.
Logic 8 (Extended 3)	Vendor	follow DATA	8MB	Ext4 Mount at /vender	For Store MAC address files.
Logic 9 (Extended 3)	Misc	Follow DATA	4M	N/A	For recovery store bootloader message, reserve.
Primary 4	MEDIA	Follow Misc	Total - Other images	VFAT	For internal media partition, in /mnt/sdcard/ dir.

Note:

- **SYSTEM Partition:** used to store Android system image.
- **DATA Partition:** used to store applications' unpacked data, system configuration databases, etc.

Under normal mode, the root file system is mounted from uramdisk. Under recovery mode, the root file system is mounted from the RECOVERY partition.

4.4 Setting up HyperTerminal

Connect MarS Board to your PC with a serial cable, and then select

Start >

Programs >

Accessories >

Communications >

HyperTerminal

Then set up a new HyperTerminal according to the parameters shown in Figure 5.

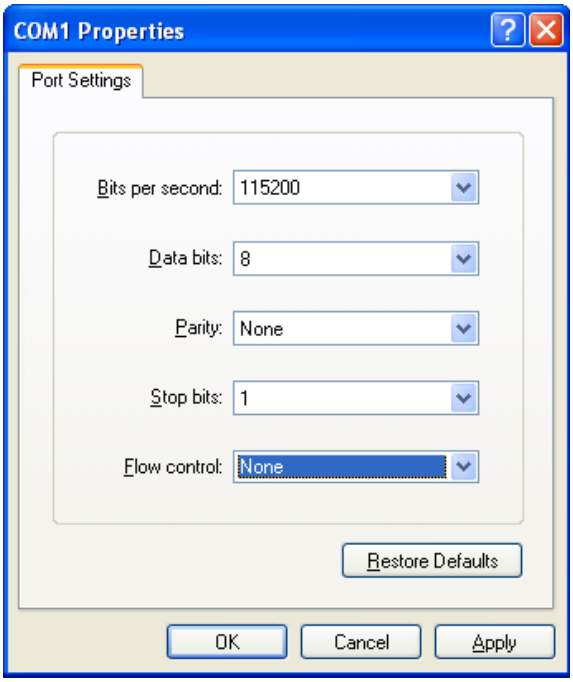


Figure 5: *HyperTerminal Configuration Settings*

4.5 Downloading and Running an Operating System

First download and extract all the below listed file from www.element14.com/iMX6:

1. Android Image File
2. Linux Image File
3. Micrium Demo File
4. Tools File

Now you can download and run the provided pre-compiles system image to the MarS Board and run it. The MFG Tool will be used to download images into the MarS board.

Note:

🕮 Please remove TF card from MarS Board before downloading an image with the MFG tool.

1) Download and copy all the files to the root directory of your hard

drive (for these instructions we assume "**C:**" is the root directory).

2) Use a Mini USB cable to connect the USB OTG interface on the MarS Board to the USB Host on your PC, and then open a HyperTerminal window

3) Set the boot switches (SW1) on the MarS Board to MFG tool mode by using the configuration shown in the following table:

Switch	D1	D2
On/Off	OFF	ON

4) If you need to download the Linux system to the MarS board, please copy the latest Linux image files "**u-boot.bin"**, "**uImag**" and "**oneiric.tgz**" to

"**C:\tools\Mfgtools-Rel-12.04.01_ER_MX6Q_UPDATER \Profiles\MX6Q Linux Update\OS Firmware\files**"

and overwrite the files with the same names.

5) If you need to download the Android system to the MarS Board, please copy the latest Android image files "**boot.img**", "**recovery.img**", "**system.img**" and "**u-boot.bin"** to

"C:\tools/Mfgtools-Rel-12.04.01_ER_MX6Q_UPDATER \Profiles\MX6Q Linux Update\OS Firmware\files\android\"

to overwrite the files with the same names

6) Run the MFG tool under "**C:\tools**" on your PC and power on the MarS Board; the software window is shown below. (The PC will install the HID drivers automatically if it is the first time connecting to an i.MX6-based product)

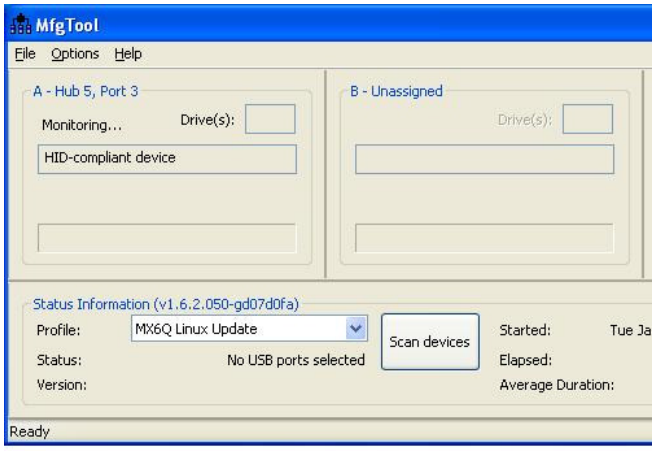


Figure 6: *MFG Tool Window*

7） Click **Scan** to automatically detect the port.

8） Select **Options** > **Configuration** on the menu bar to open the following window

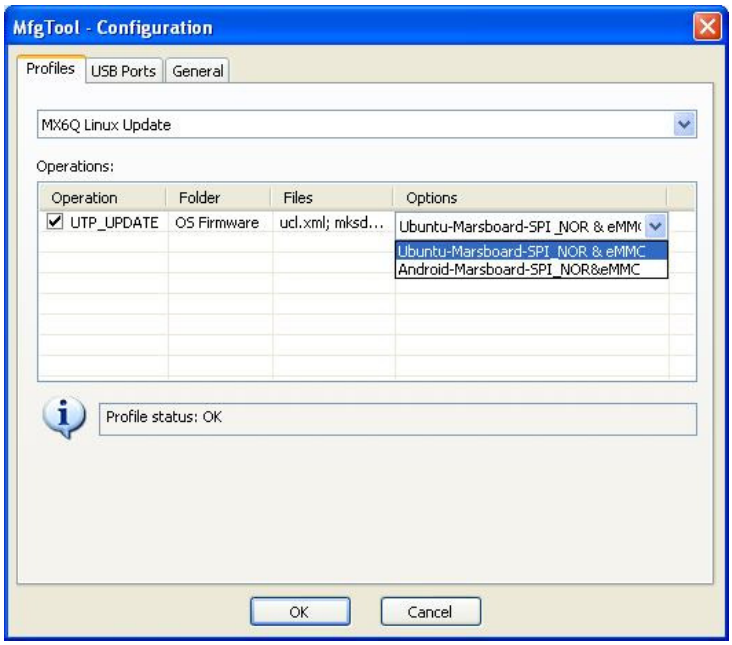


Figure 7: *MFG Tool Configuration*

9） Select the **Profiles** tab and click on the drop-down menu in the **Options** column to select an option

Note:

- For Linux systems, please select **Ubuntu-Marsboard-SPI_NOR & eMMC**
- For Android systems, please select **Android-Marsboard-SPI_NOR&eMMC**

10） Click **OK** after configuration is done

11） Click **Start** in the following window

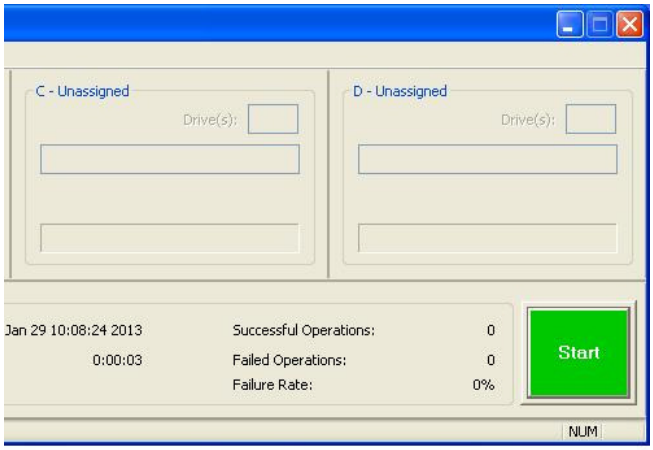


Figure 8: *Start Button Location*

12） When the download process is done, click **Stop** to finish.

13） Power off MarS Board and set the boot switches (SW1) on it to SPI-NOR boot mode according to the configuration shown In the following table

Switch	D1	D2
On/Off	OFF	OFF

14） After the switch is set, you can power on MarS Board to boot the system.

Note:

- Please Do Not insert a TF card while downloading images with MFG tool.
- The parameter used by u-boot is stored in SPI-NOR flash; if you want to reset it, please execute instructions **sf probe 0** and **sf erase 0xc0000 0x2000** in the HyperTerminal window.

4.6 Micrium uC/OS System Demonstration

Note:

- The uC/OS system is supplied for demo purposes; we do not support the source code

1) First download the "**Micrium Demo File**" from www.element14.com/iMX6 and extract all the files. Now copy the "**u-boot.bin**" and "**uImag**" files under "**Micrium/demo/ucos**" to "**C:/tools/Mfgtools-Rel-12.04.01_ER_MX6Q_UPDATER \Profiles\MX6Q Linux Update\OS Firmware\files**" and overwrite the files with the same names

2) Refer to the download method of Linux image in section 4.5 for the instructions to download the uC/OS system image into the MarS board.

3) Now copy all of the files under "**Micrium/demo/ucos**" to a TF card, insert the TF card into Mars Board; connect a 7" LCD and HDMI TV, and then power on the board; the dual operating systems will be running concurrently. The uC/OS system will display on the 7" LCD & the Ubuntu system will display on the HDMI TV.

4.7 Display Mode Configurations of Linux & Android Systems

The system supports multiple display modes. Users can select an appropriate mode by configuring the u-boot parameters. Please reboot the

kit and press any key on your PC's keyboard when prompted by the system.

You will be presented with a countdown in seconds as shown below:

```
U-Boot 2009.08-svn1 (Mar 14 2013 - 14:07:49)

CPU: Freescale i.MX6 family TO0.0 at 792 MHz
Temperature:   51 C, calibration data 0x58150469
mx6q pll1: 792MHz
mx6q pll2: 528MHz
mx6q pll3: 480MHz
mx6q pll8: 50MHz
ipg clock     : 66000000Hz
ipg per clock : 66000000Hz
uart clock    : 80000000Hz
cspi clock    : 60000000Hz
ahb clock     : 132000000Hz
axi clock   : 264000000Hz
emi_slow clock: 29333333Hz
ddr clock     : 528000000Hz
usdhc1 clock  : 198000000Hz
usdhc2 clock  : 198000000Hz
usdhc3 clock  : 198000000Hz
usdhc4 clock  : 198000000Hz
nfc clock     : 24000000Hz
Board: MX6Q-MARSBOARD:[ POR]
Boot Device: I2C
I2C:   ready
DRAM:   1 GB
MMC:   FSL_USDHC: 0,FSL_USDHC: 1
JEDEC ID: 0xbf:0x25:0x41
Reading SPI NOR flash 0xc0000 [0x2000 bytes] -> ram 0x276009b8
SUCCESS

*** Warning - bad CRC, using default environment

In:    serial
Out:   serial
Err:   serial
Net:   got MAC address from IIM: 00:00:00:00:00:00
----enet_board_init: phy reset
FEC0 [PRIME]
Hit any key to stop autoboot:  0 ( press any key to enter u-boot command
mode)
MX6Q MARSBOARD U-Boot >
```

4.7.1 Display with 4.3” LCD

Execute the following instructions in u-boot mode to configure the system for 4.3” display mode:

```
MX6Q MARSBOARD U-Boot > setenv bootargs console=ttymxc1,115200 init=/init
rw video=mxcfb0:dev=lcd,4.3inch_LCD,if=RGB24 fbmem=10M vmalloc=400M
androidboot.console=ttymxc1 calibration
```

4.7.2 Display with 7” LCD

Execute the following instructions in u-boot mode to configure the system for 7” display mode:

```
MX6Q MARSBOARD U-Boot > setenv bootargs console=ttymxc1,115200 init=/init
rw video=mxcfb0:dev=lcd,7inch_LCD,if=RGB24 fbmem=10M vmalloc=400M
androidboot.console=ttymxc1 calibration
```

4.7.3 Display with 9.7” LVDS

Execute the following instructions in u-boot mode to configure the system for 9.7” display mode:

```
MX6Q MARSBOARD U-Boot > setenv bootargs console=ttymxc1,115200 init=/init
rw video=mxcfb0:dev=ldb,LDB-XGA,if=RGB666 fbmem=10M vmalloc=400M
androidboot.console=ttymxc1
```

4.7.4 Display with VGA8000

Execute the following instructions in u-boot mode to configure the system for VGA8000 display mode:

```
MX6Q MARSBOARD U-Boot > setenv bootargs console=ttymxc1,115200 init=/init
```

```
rw video=mxcfb0:dev=lcd,VGA,if=RGB24 fbmem=10M vmalloc=400M
androidboot.console=ttymxc1
```

4.7.5 Display with HDMI

Execute the following instructions in u-boot mode to configure the system for HDMI display mode:

```
MX6Q MARSBOARD U-Boot > setenv bootargs console=ttymxc1,115200 init=/init
rw video=mxcfb0:dev=hdmi,1920x1080M@60,if=RGB24 fbmem=10M vmalloc=400M
androidboot.console=ttymxc1
```

4.7.6 Dual Display with LCD & HDMI

1） Execute the following instructions in u-boot mode to configure the system for HDMI and 4.3” LCD dual display mode:

```
MX6Q MARSBOARD U-Boot > setenv bootargs console=ttymxc1,115200 init=/init
rw video=mxcfb0:dev=lcd,4.3inch_LCD,if=RGB24
video=mxcfb1:dev=hdmi,1920x1080M@60,if=RGB24 fbmem=10M vmalloc=400M
androidboot.console=ttymxc1 calibration
```

2） Execute the following instructions in u-boot mode to configure the system for HDMI and 7” LCD dual display mode:

```
MX6Q MARSBOARD U-Boot > setenv bootargs console=ttymxc1,115200 init=/init
rw video=mxcfb0:dev=lcd,7inch_LCD,if=RGB24
video=mxcfb1:dev=hdmi,1920x1080M@60,if=RGB24 fbmem=10M vmalloc=400M
androidboot.console=ttymxc1 calibration
```

4.7.7 Dual Display with LVDS & HDMI

Execute the following instructions in u-boot mode to configure the system for HDMI and 9.7” LVDS dual display mode:

```
MX6Q MARSBOARD U-Boot > setenv bootargs console=ttymxc1,115200 init=/init
rw video=mxcfb0:dev=ldb,LDB-XGA,if=RGB666
video=mxcfb1:dev=hdmi,1920x1080M@60,if=RGB24 fbmem=10M vmalloc=400M
androidboot.console=ttymxc1
```

Note:

- At time of writing only Android systems support Dual Display.
- The u-boot parameter is stored in SPI-NOR flash, if you want to reset it, please use the command: MX6Q MARSBOARD U-Boot > **run clearenv**

5 Making Images

This Chapter will introduce how to make images by using the BSP, the BSP is a collection of binary, source code, and support files that can be used to create a u-boot, bootloader, Linux kernel image, and Android file system for i.MX 6Dual Mars Board. All the source code for Linux & Android system can be downloaded from www.element14.com/iMX6

1. Linux Source Code
2. Android Source Code
3. Tools

Note:

- The following instructions are all executed under Ubuntu system.
- Each instruction has been proceeded by a pencil "✎" to prevent confusion caused by the long instructions that occupy more than one line in the document.

5.1 Making Images for Linux

Please carefully follow the steps listed below to make images for a Linux system.

5.1.1 Getting Tools and Source Code

1) Execute the following instructions to get the cross compiling tool chain:

✎ `$ cd ~`

✎ `$ git clone git://github.com/embest-tech/platform_prebuilt.git`

4) Execute the following instructions to get the u-boot source code:

✎ `$ cd ~`

- `$ git clone git://github.com/embest-tech/uboot-imx.git`

5) Execute the following instructions to get the kernel source code:

- `$ cd ~`
- `$ git clone git://github.com/embest-tech/kernel_imx.git`

5.1.2 Compiling System Images

1) Execute the following instructions to compile a u-boot image:

- `$ cd ~ /uboot-imx`
- `$ export ARCH=arm`
- `$export CROSS_COMPILE=~/platform_prebuilt/linux-x86/toolchain/arm-eabi-4.4.3/bin/arm-eabi-`
- `$ make distclean`
- `$ make mx6q_marsboard_ config`
- `$ make`

Note:

After executing the instructions, a file u-boot.bin can be found in the current directory:

6) Execute the following instructions to compile kernel image;

- `$export PATH=~/uboot-imx/tools:$PATH`
- `$ cd ~/kernel_imx`
- `$ echo $ARCH && echo $CROSS_COMPILE`
- `$ export ARCH=arm`
- `$export CROSS_COMPILE=~/platform_prebuilt/linux-x86/toolchain/arm-eabi-4.4.3/bin/arm-eabi-`
- `$ make imx6_marsboard_defconfig`

- `$ make uImage`

Note:

- After executing the instructions, a kernel image named uImage can be found under arch/arm/boot/.

Note:

- The mkimage used to build kernel and ramfs images is automatically generated and saved under tools/ after compiling u-boot.bin, so please make sure uboot is compiled first before compiling kernel image.
- Copy the u-boot.bin and uImag files that are generated by compiling to C:/tools/Mfgtools-Rel-12.04.01_ER_MX6Q_UPDATER \Profiles\MX6Q Linux Update\OS Firmware\files\ to overwrite the files with the same names and then restart the instructions from step 2 (p21) so as to verify the Linux system you built.

5.2 Making Images for Android

Please carefully follow the steps listed below to make images for an Android system.

5.2.1 Getting Repo Source Code

1） Execute he following instructions to get repo source code;

- `$ mkdir ~/bin`
- `$ curl https://github.com/android/tools_repo/blob/master/repo > ~/bin/repo`
- `$ chmod a+x ~/bin/repo`
- `$ export PATH=~/bin:$PATH`

2） Execute he following instructions to initialize repo source code;

- `$ mkdir ~/android-imx6-r13.3`
- `$ cd ~/android-imx6-r13.3`

- `$ repo init --repo-url=git://github.com/android/tools_repo.git -u git://github.com/embest-tech/android-imx6-r13.3.git`

3） Execute the following instructions to synchronize repo source code;

- `$ cd ~/android-imx6-r13.3`
- `$ repo sync`

5.2.2 Compiling System Images

1） Execute the following instructions to compile Android image;

- `$ cd ~/android-imx6-r13.3`
- `$ source build/envsetup.sh`
- `$ lunch marsboard_6q-user`
- `$ make`

After executing the instructions, the generated images can be found under:

"**android-imx6-r13.3/out/target/product/marsboard_6q/**"

The table shown below lists all the images and directories after compilation is completed.

Images and Directories

Images/Directories	Notes
root/	root file system, mounted at /
system/	Android system directory, mounted at /system
data/	Android data area. mounted at /data
recovery/	Root file system when booting in "recovery" mode, not used directly
boot.img	A composite image which includes the kernel zImage, ramdisk, and boot parameters
ramdisk.img	Ramdisk image generated from "root/", not directly used
system.img	EXT4 image generated from "system/". Can be written to "SYSTEM" partition of

Images/Directories	Notes
	SD/eMMC card with "dd" command
userdata.img	EXT4 image generated from "data/"
recovery.img	EXT4 image generated from "recovery/". Can be written to "RECOVERY" partition of SD/eMMC card with "dd" command
u-boot.bin	uboot image with padding

Note:

🕮 The Android image should be built in user mode; please visit http://source.android.com/source/building.html for more information.

2） Execute the following instructions to compile boot.img;

- **$ source build/envsetup.sh**
- **$ lunch marsboard_6q-user**
- **$ make bootimage**

After executing the instructions, a boot.img image can be found under: "**android-imx6-r13.3/out/target/product/marsboard_6q/**".

Note：

🕮 The mkimage used to build kernel and ramfs images is automatically generated and saved under tools/ after compiling u-boot.bin, so please make sure uboot is compiled first before compiling a kernel image.

🕮 Copy the boot.img, placeholder, recovery.img, system.img and u-boot.bin files that are generated by compiling to C:/tools/Mfgtools-Rel-12.04.01_ER_MX6Q_UPDATER \Profiles\MX6Q Linux Update\OS Firmware\files\ to overwrite the files with the same names and then restart the instructions from step 2 (p22) so as to verify the Android system you built.

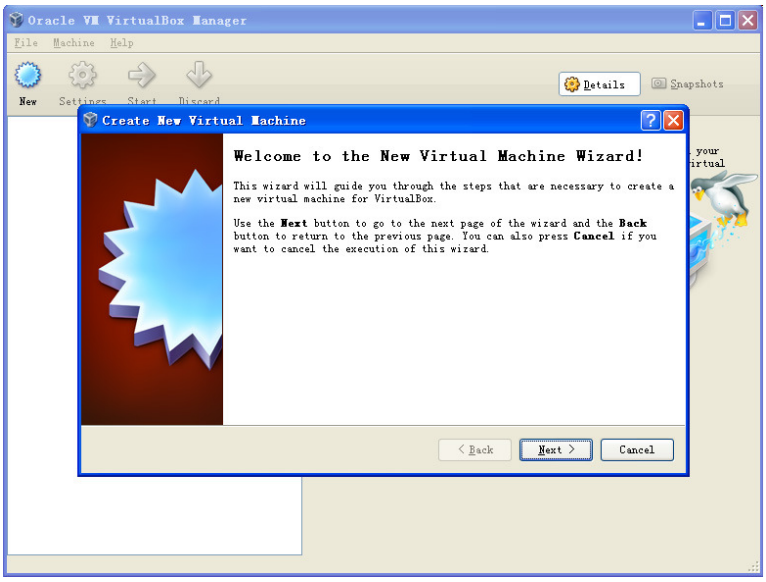
6 Appendix 1 – Installing Ubuntu Linux System

An appropriate development environment is required for software development. The CD included with product contains a development environment which needs to be installed under a Linux environment. If you are working on a PC running Windows, you have to create a Linux system first, and then you can install the environment. An easy method for achieving this is to use virtual machine software such as VirtualBox to install Ubuntu Linux on an emulated/virtual PC. The following sections will introduce the installation processes of VirtualBox and Ubuntu system.

6.1 Installing VirtualBox

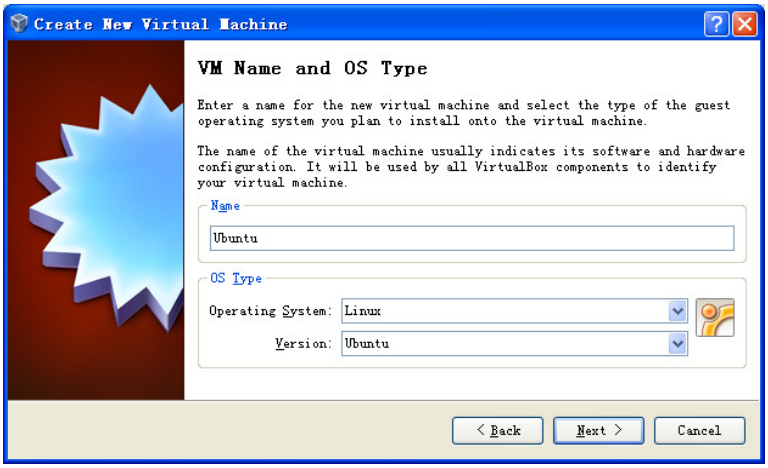
You can access http://www.virtualbox.org/wiki/Downloads to download the latest version of VirtualBox. VirtualBox requires a minimum of 512MB of RAM to run however 1GB is recommended.

1) The installation process is simple. Start VirtualBox from the **Start** menu of Windows, and then click **New** in the VirtualBox window. A pop-up window titled "Create New Virtual Machine" will be shown as below:


Oracle VM VirtualBox Manager
File Machine Help
New Settings Start Discard
Details Snapshots
Create New Virtual Machine
Welcome to the New Virtual Machine Wizard!
This wizard will guide you through the steps that are necessary to create a new virtual machine for VirtualBox.
Use the Next button to go to the next page of the wizard and the Back button to return to the previous page. You can also press Cancel if you want to cancel the execution of this wizard.
Back
Next >
Cancel

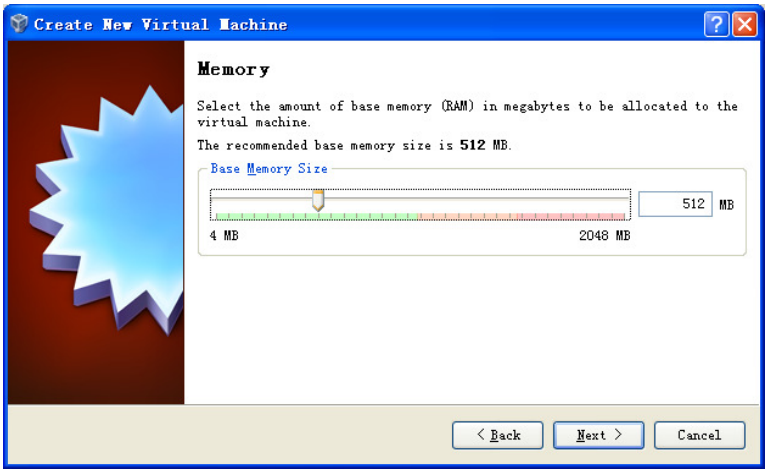
7) Click **Next** to create a new virtual machine.

8) Enter a name for the new virtual machine and select the operating system type as shown below:


Create New Virtual Machine
VM Name and OS Type
Enter a name for the new virtual machine and select the type of the guest operating system you plan to install onto the virtual machine.
The name of the virtual machine usually indicates its software and hardware configuration. It will be used by all VirtualBox components to identify your virtual machine.
Name
Ubuntu
OS Type
Operating System: Linux
Version: Ubuntu
< Back
Next >
Cancel

9) Enter a name in the **Name** field, e.g. Ubuntu, and select **Linux** in the **Operating System** drop-down menu, and then click **Next**.

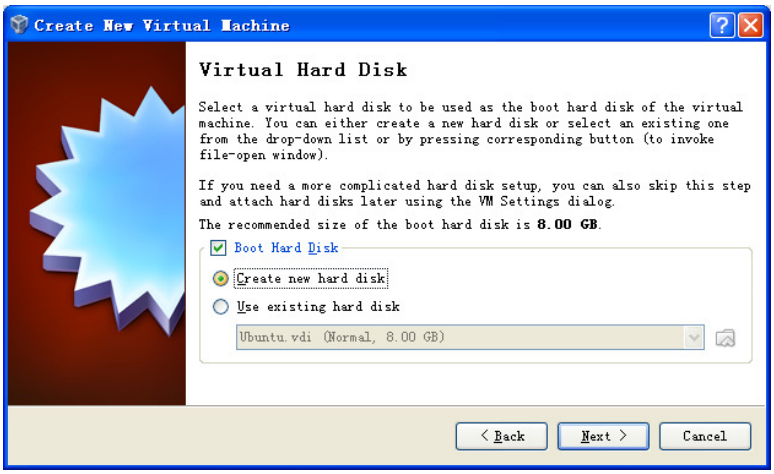
10) Allocate memory to the virtual machine and then click **Next**


Create New Virtual Machine
Memory
Select the amount of base memory (RAM) in megabytes to be allocated to the virtual machine.
The recommended base memory size is 512 MB.
Base Memory Size
512 MB
4 MB
2048 MB
< Back
Next >
Cancel

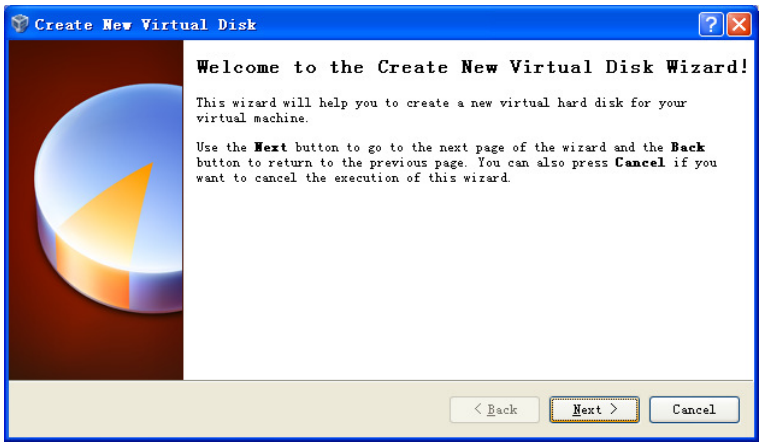
Note:

- If your PC has 1GB of RAM or lower, keep the default setting;
- If your PC more than 1GB of RAM, you can allocate up to 1/4 to the virtual machine, for example, 512MB out of 2GB memory could be allocated to virtual machine.

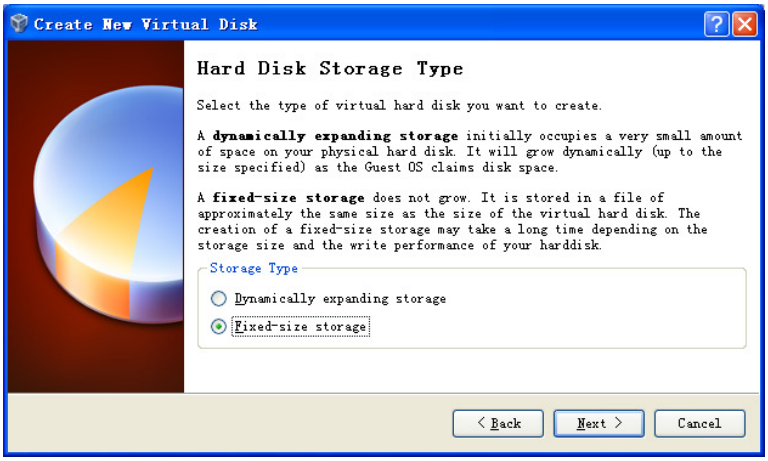
11) If this is the first time you have installed VirtualBox, you need to select **Create new hard disk** in the following window, and then click **Next**


Create New Virtual Machine
Virtual Hard Disk
Select a virtual hard disk to be used as the boot hard disk of the virtual machine. You can either create a new hard disk or select an existing one from the drop-down list or by pressing corresponding button (to invoke file-open window).
If you need a more complicated hard disk setup, you can also skip this step and attach hard disks later using the VM Settings dialog.
The recommended size of the boot hard disk is 8.00 GB.
Boot Hard Disk
Create new hard disk
Use existing hard disk
Ubuntu.vdi (Normal, 8.00 GB)
< Back
Next >
Cancel

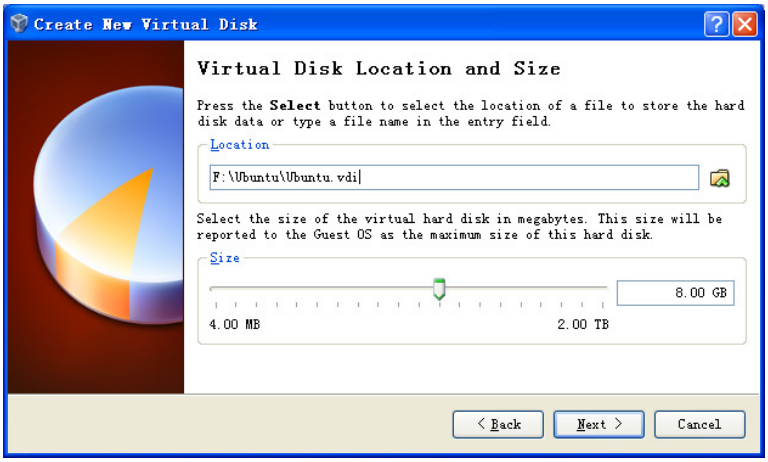
12) Click **Next** in the following window


Create New Virtual Disk
Welcome to the Create New Virtual Disk Wizard!
This wizard will help you to create a new virtual hard disk for your virtual machine.
Use the Next button to go to the next page of the wizard and the Back button to return to the previous page. You can also press Cancel if you want to cancel the execution of this wizard.
< Back
Next >
Cancel

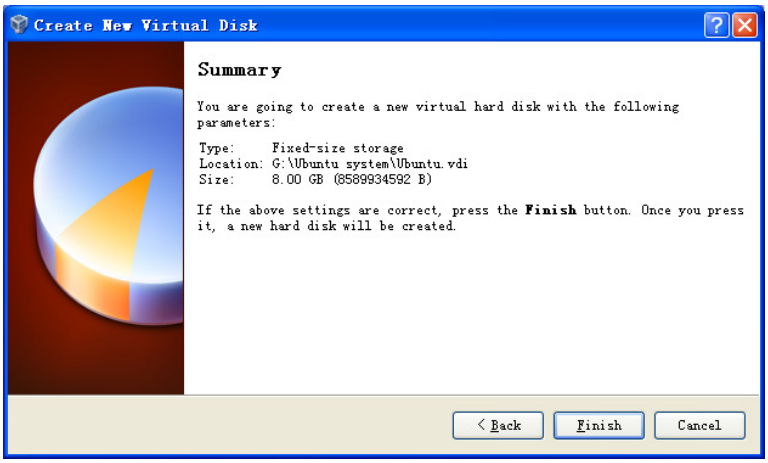
13) Select **Fixed-size storage** in the following window and click **Next**


Create New Virtual Disk
Hard Disk Storage Type
Select the type of virtual hard disk you want to create.
A dynamically expanding storage initially occupies a very small amount of space on your physical hard disk. It will grow dynamically (up to the size specified) as the Guest OS claims disk space.
A fixed-size storage does not grow. It is stored in a file of approximately the same size as the size of the virtual hard disk. The creation of a fixed-size storage may take a long time depending on the storage size and the write performance of your harddisk.
Storage Type
Dynamically expanding storage
Fixed-size storage
< Back
Next >
Cancel

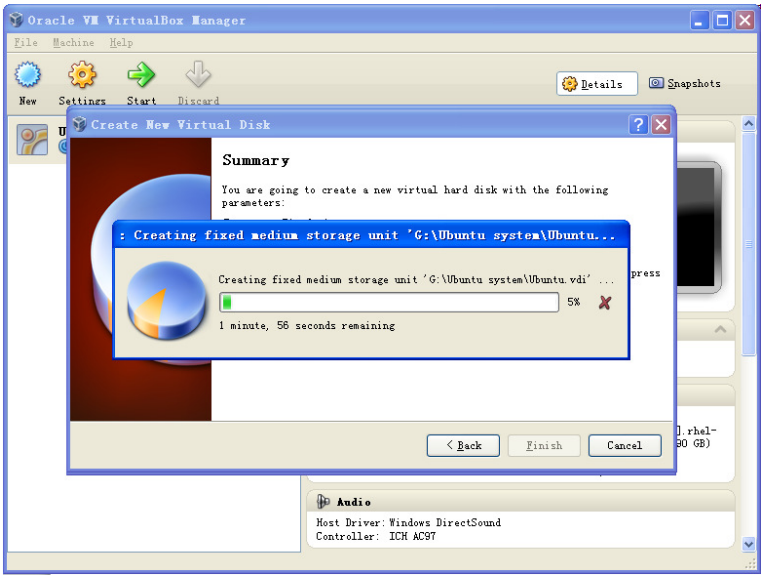
14) Define where the hard disk data is stored and the default space of the virtual disk (8GB at least), and then click **Next**


Create New Virtual Disk
Virtual Disk Location and Size
Press the Select button to select the location of a file to store the hard disk data or type a file name in the entry field.
Location
F:\Ubuntu\Ubuntu.vdi
Select the size of the virtual hard disk in megabytes. This size will be reported to the Guest OS as the maximum size of this hard disk.
Size
8.00 GB
4.00 MB
2.00 TB
< Back
Next >
Cancel

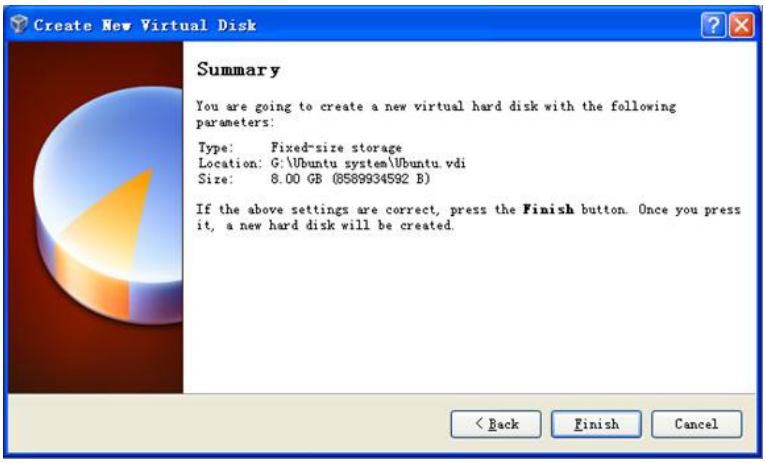
15) Click **Finish** in the following window


Create New Virtual Disk
Summary
You are going to create a new virtual hard disk with the following parameters:
Type: Fixed-size storage
Location: G:\Ubuntu system\Ubuntu.vdi
Size: 8.00 GB (8589934592 B)
If the above settings are correct, press the Finish button. Once you press it, a new hard disk will be created.
< Back
Finish
Cancel

16) Your PC will then create a new virtual disk



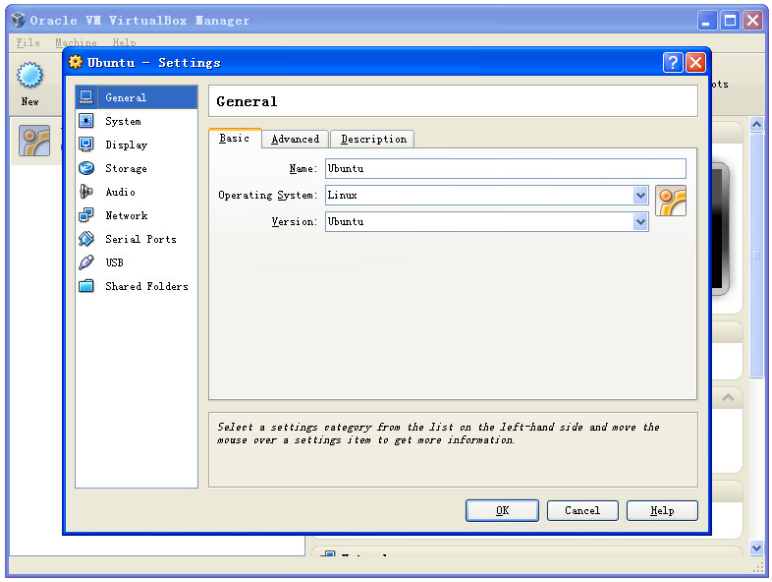
17) A window with summary of the newly created virtual machine will be shown as below when the creation process is done. Please click **Finish** to complete the whole process.


Create New Virtual Disk
Summary
You are going to create a new virtual hard disk with the following parameters:
Type: Fixed-size storage
Location: G:\Ubuntu system\Ubuntu.vdi
Size: 8.00 GB (8589934592 B)
If the above settings are correct, press the Finish button. Once you press it, a new hard disk will be created.
< Back
Finish
Cancel

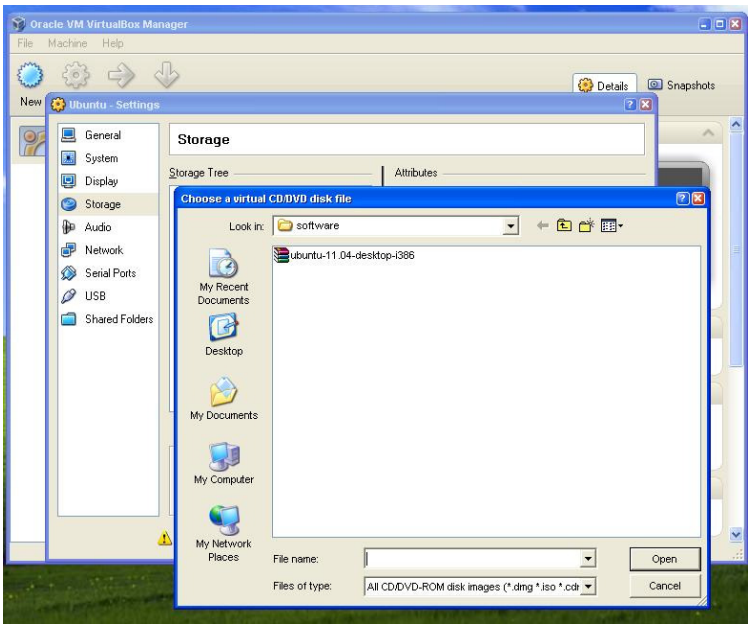
6.2 Installing Ubuntu Linux System

After VirtualBox is installed, we can install the Ubuntu Linux system. Visit http://www.Ubuntu.com/download/Ubuntu/download to download the ISO image file of Ubuntu, and then follow the steps below:

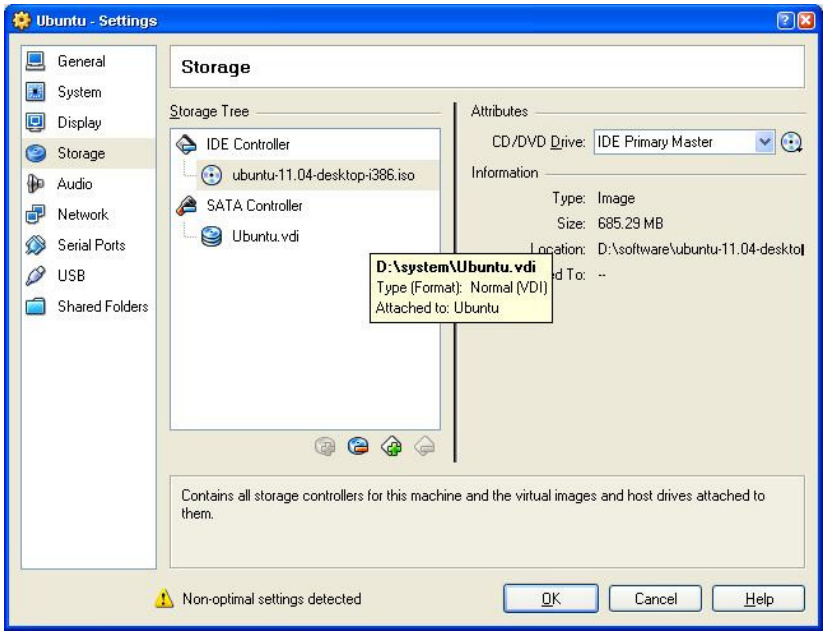
1) Start VirtualBox from the **Start** menu and click **Settings** on the VirtualBox window. A **Settings** window will be shown as below



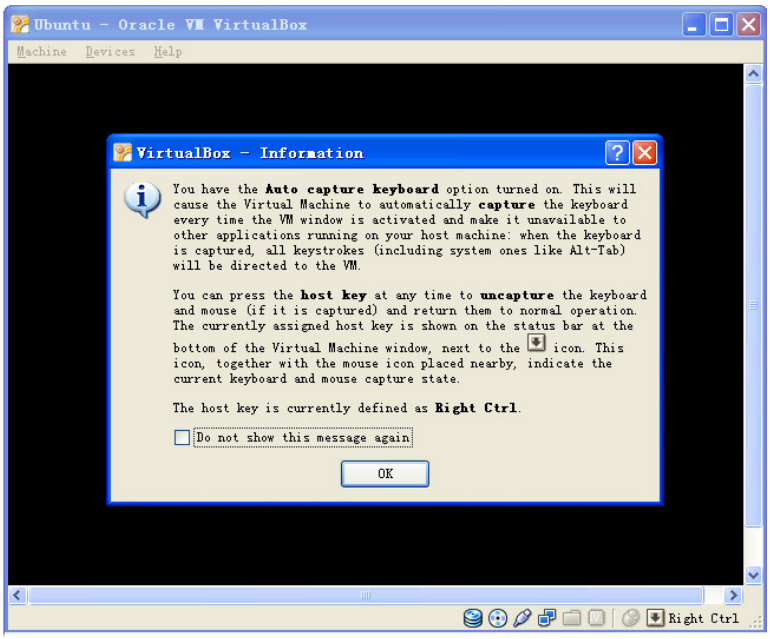
18) Select **Storage** on the left in the **Settings** window and click the CD icon next to the option **Empty** under IDC controller in the right part of the window, and then find the ISO file you downloaded



19) Select the ISO file you downloaded and click **OK** as shown below

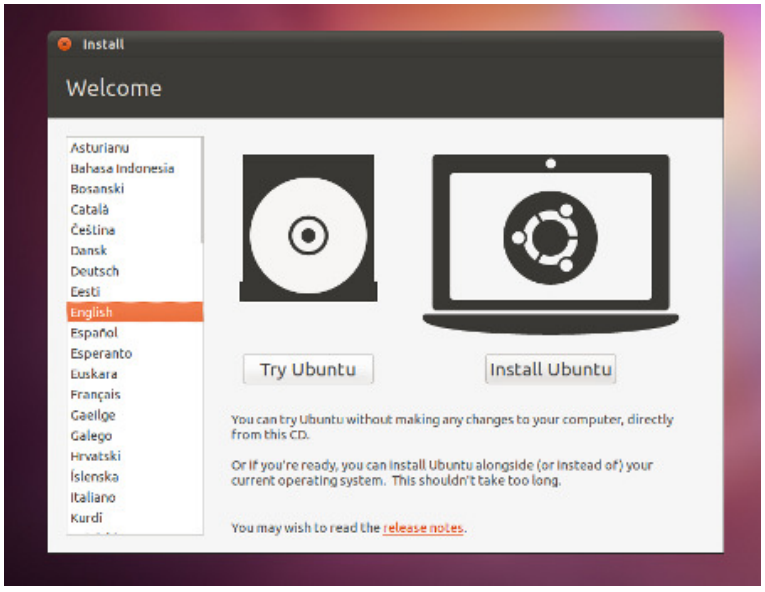


20) Click **Start** on the VirtualBox window, the Ubuntu installation program will start as shown below:

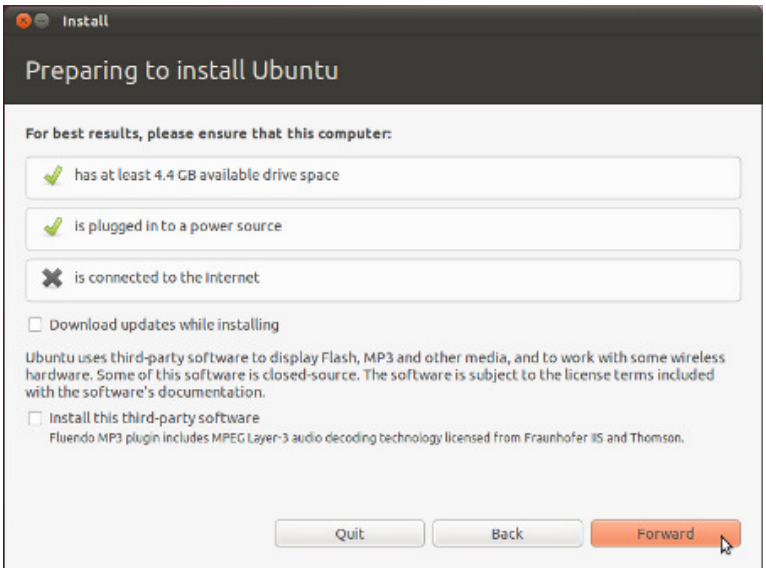

Ubuntu - Oracle VM VirtualBox
Machine Devices Help
VirtualBox - Information
You have the Auto capture keyboard option turned on. This will cause the Virtual Machine to automatically capture the keyboard every time the VM window is activated and make it unavailable to other applications running on your host machine: when the keyboard is captured, all keystrokes (including system ones like Alt-Tab) will be directed to the VM.
You can press the host key at any time to uncapture the keyboard and mouse (if it is captured) and return them to normal operation. The currently assigned host key is shown on the status bar at the bottom of the Virtual Machine window, next to the icon. This icon, together with the mouse icon placed nearby, indicate the current keyboard and mouse capture state.
The host key is currently defined as Right Ctrl.
Do not show this message again
OK
Right Ctrl

21) Some prompt windows will pop up during the initiation process. You just need only click **OK** all the way to the end of the process.

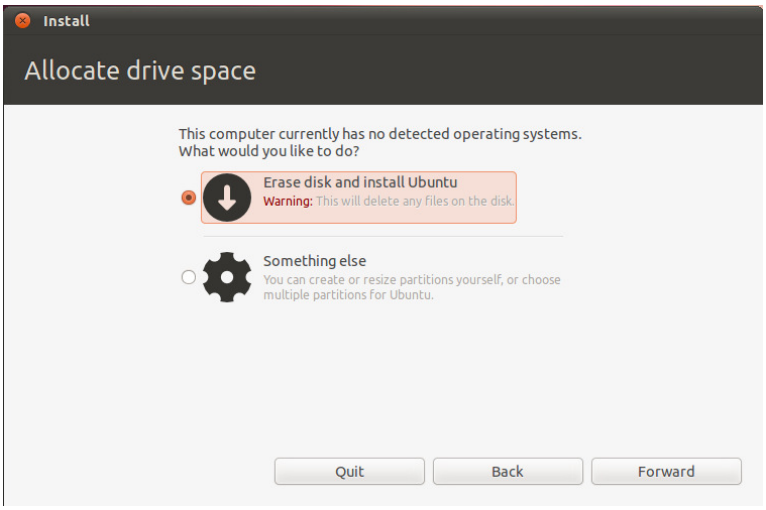
22) Click **Install Ubuntu** to start installation when the following window appears



23) Click **Forward** to continue the process


Install
Preparing to install Ubuntu
For best results, please ensure that this computer:
has at least 4.4 GB available drive space
is plugged in to a power source
is connected to the Internet
Download updates while installing
Ubuntu uses third-party software to display Flash, MP3 and other media, and to work with some wireless hardware. Some of this software is closed-source. The software is subject to the license terms included with the software's documentation.
Install this third-party software
Fluendo MP3 plugin includes MPEG Layer-3 audio decoding technology licensed from Fraunhofer IIS and Thomson.
Quit
Back
Forward

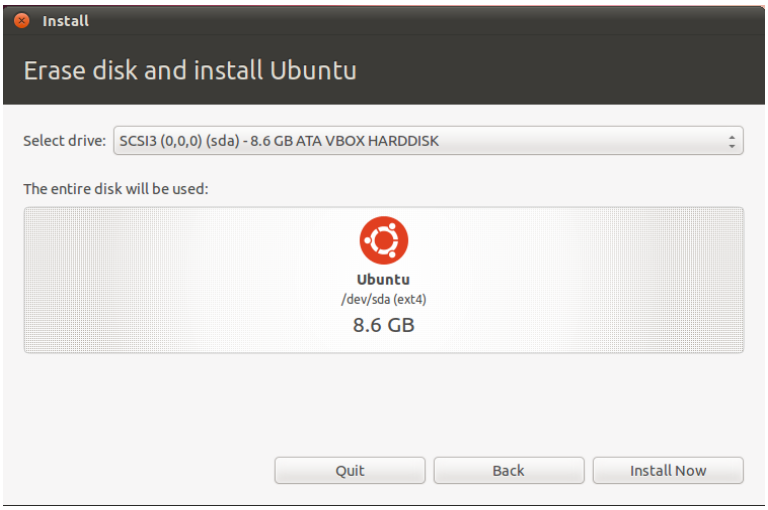
24) Select Erase disk and install Ubuntu and click Forward


Install
Allocate drive space
This computer currently has no detected operating systems.
What would you like to do?
Erase disk and install Ubuntu
Warning: This will delete any files on the disk.
Something else
You can create or resize partitions yourself, or choose multiple partitions for Ubuntu.
Quit
Back
Forward

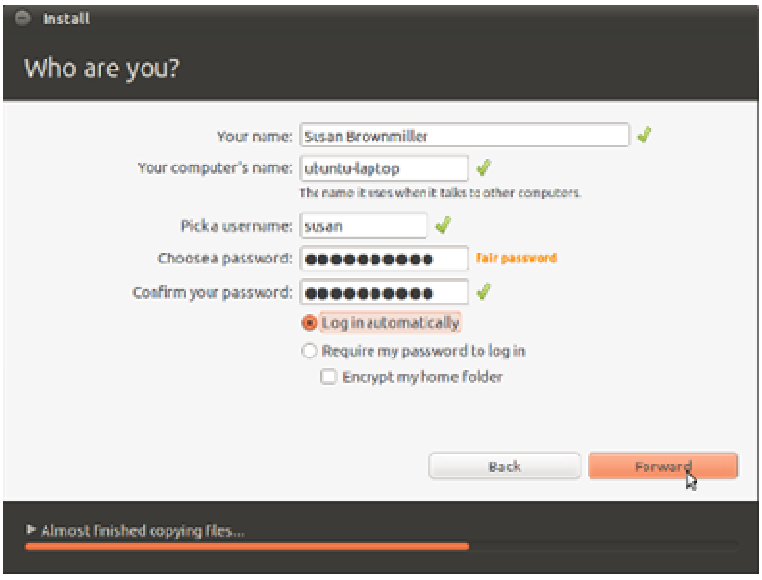
Note:

🕮 Selecting this option will only affect the virtual hard drive you created earlier and will not lead to any content loss on your hard drive.

25) Click **Install Now** in the following window to start installation:

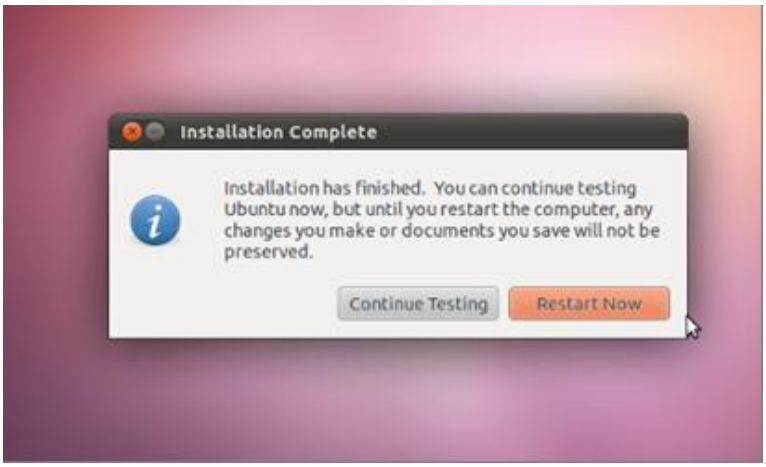


26) Some simple questions need to be answered during the installation process. Please enter appropriate information and click **Forward**. The following window is the last question that will appear during the process:



27) After all the required information is properly entered in to the fields, select **Log in automatically** and click **Forward**.

28) The installation of Ubuntu may take between 15 minutes to an hour depending on your PC's specification. A prompt window will be shown as below after installation is done. Please select **Restart Now** to restart Ubuntu system.


Installation Complete
Installation has finished. You can continue testing Ubuntu now, but until you restart the computer, any changes you make or documents you save will not be preserved.
Continue Testing
Restart Now

29) The Ubuntu system is ready for use after restarting. Normally the ISO file shown below will be ejected automatically by VirtualBox after restarting Ubuntu. If it is not, you can eject the ISO file manually in the **Settings** window of VirtualBox. The following window shows the settings window after the ISO file is ejected.